

TWO-WAY RADIO



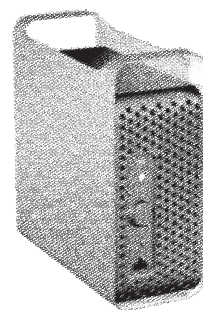
## SERVICE MANUAL PORTABLE REPEATER

# TR-50

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Shenzhen HYT Science & Technology Co., Ltd.



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## General

### Manual Scope

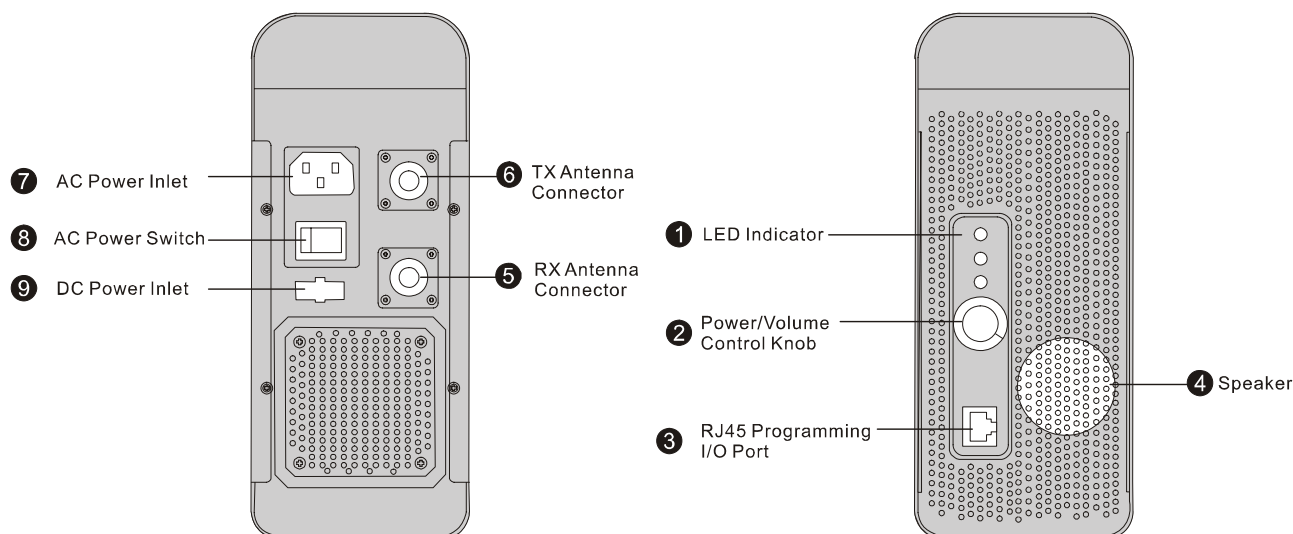
This manual is intended for use by experienced technicians familiar with similar types of communication equipment. It contains all service information required for the equipment and is current as of the publication date.

### User Safety Information

The following precautions are recommended for personnel safety:

- DO NOT transmit until all RF connectors are verified secure and any open connectors are properly terminated.
- SHUT OFF and do not operate this equipment near electrical blasting caps or in an explosive atmosphere.
- When in vehicles with an airbag, do not place a repeater in the area over an airbag or in the airbag deployment area.
- DO NOT expose the repeater to direct sunlight for a long time nor place it close to a heating source.
- DO NOT use any repeater with a damaged antenna. If a damaged antenna comes into contact with your skin, a minor burn may result.
- This equipment should be serviced by a qualified technician only.

## Brief Introduction



### 1. LED Indicator

The following table indicates LED indication and corresponding radio status.

LED	Status
Red	Power on
Green	Receive (or in battery save mode)
Blue	Transmit

### 2. Power /Volume Control Knob

Rotate the Power/Volume Control Knob clockwise until a “click” is heard to turn the repeater on. Then the LED turns red when the power is on. Rotate counter-clockwise to turn the repeater off until a “click” is heard. When the repeater is on, turn the Knob to adjust volume. (Suggestion: adjust volume to the lowest while Monitoring is unnecessary.)

### 3. RJ45 Programming I/O Port

Used by the dealer to program the repeater’s receiver and transmitter respectively.

### 4. Speaker

Used to monitor the communication status of current channel.

### 5. Rx Antenna Connector

N/F type RF connector.

### 6. Tx Antenna Connector

N/F type RF connector. Applied as antenna port when duplexer is installed.

**7. AC Power Inlet**

After correctly connecting AC power supply, turn on the switch to enter AC power supply mode.

**8. AC Power Switch**

**9. DC Power Inlet**

The float charging function will operate in AC power supply mode with external gel cell batteries connected. When AC mains power is lost, it will auto-revert to the back-up battery supply without mechanical relay.

# Theory of Operation

## I. Power Control

The control board draws a general 13.8V dc power supply, which is converted through U1, a 3-terminal regulator, to 8.0V dc for the receiver and transmitter.

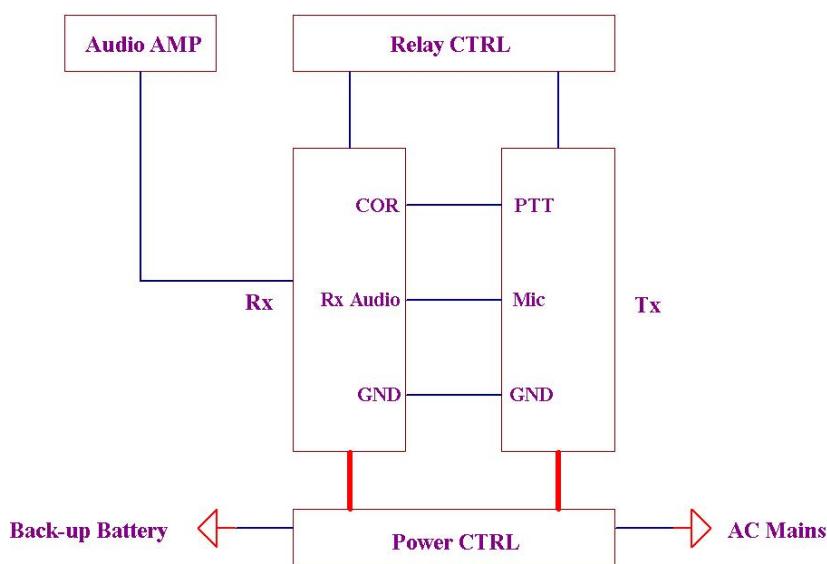


Fig. 1 Power Supply Block Diagram

## II. Relay Control

When a valid signal is detected, the COR goes low and trigger PTT of the transmitter. At the same time, the audio output from discriminator is routed to MIC input of the transmitter. The trimmable resistor VR3 is used to adjust the receive audio output to the proper level for transmit audio deviation.

## III. Float Charging Function

The TR-50 provides selectable AC (100-240V ac) power supply. Normally users can equip battery back-up system connected to the external DC jack with floating charge function in the mean time. This provides auto-revert to DC battery once the AC mains fails.

## IV. Fan Control

This repeater provides three options of cooling fan control: PTT controlled, temperature controlled and continuous operation. The power supply of the fan is controlled through a 5V voltage detector, HT7050A. When the input is above 5V, the output is high-Z; when lower than 5V, the output goes low.

## V. AF Amplification

The receive audio is routed to another AF amplifier NJM386M, which is convenient for the users to monitor the activities of current channel.

## VI. Definition for control ports

The definition of all the pins goes as follows:

1. J3
 

1pin	NC	
2pin	TLED-	
3pin	MIC+	Transmitter
4pin	PTT	
5pin	TLED+	
6pin	RLED+	
7pin	SP+	
8pin	RLED-	Receiver
9pin	Rx AF	
10pin	COR	
2. J6
 

1pin	ETxD	
2pin	ERxD	Transmitter
3pin	ATxD	
4pin	ARxD	Receiver
3. RJ45 EXT
 

1pin	ARxD
2pin	MIC
3pin	ATxD
4pin	ERxD
5pin	GND
6pin	ETxD
7pin	EXT PTT
8pin	SB+ (8V)

## Alignment & Calibration

### I. Required Test Instrument

1. DC power supply                      1 set
  - 1) Output range: 12~15 VDC (Minimum); output current: 3 A or more
  - 2) Specified output: 13.8 VDC
  - 3) The output should be stable, with minimal ripple & noise.
2. Ammeter                                      1 set
3. Digital voltmeter                              1 set
4. Radio communication test set              1 set (with duplex function)

### II. Test and Adjustment

1. Power supply

Item	Condition	Measurement		Adjustment		Specification/ Remarks
		Test Instrument	Test Point	Part	Method	
DC output voltage		Digital Voltmeter	DC output terminal	Potentiometer in Switch power supply	Use ceramic adjuster to adjust till the voltage is within requirement.	13.8±0.2V

2. Power Supply for receiver and transmitter

Item	Condition	Measurement		Adjustment		Specification/ Remarks
		Test Instrument	Test Point	Part	Method	
Power Supply		Digital Voltmeter	VDD	VR1	Use ceramic adjuster to adjust VR1 till the voltage is within requirement.	8.0±0.2V

3. Relay Component (Note: Before adjustment, make sure the antenna (dummy load) are properly connected and space-isolated)

Item	Condition	Measurement		Adjustment		Specification/ Remarks
		Test Instrument	Test Point	Part	Method	
Operation Frequency	PC operation system: WIN98SE /WIN2000 Programming software: HT-50E		RJ45 Programming port			<b>Receiver:</b> 1CH 455.0125MHz 2CH 455.0125MHz CTCSS: 67.0Hz 3CH 455.0125MHz CDCSS: 025 <b>Transmitter:</b> 1CH 465.0125MHz 2CH 465.0125MHz CTCSS: 67.0Hz 3CH 465.0125MHz CDCSS: 025
Relay deviation	Turn to CH1 and enter duplex mode. With Transmitter connected to "RF in" port and receiver to "Dual out" port. Align the output of "RF GEN" to 455.0125MHz.	BPF:0. 3~3KHz AF OUT: 1KHz/150mV	Antenna	VR3	Use ceramic adjuster to rotate VR3 until the deviation is within requirement.	Frequency deviation: 3.0±0.2KHz
Tx Power	Turn to CH1, press PTT key on handheld microphone to transmit (or check Tx power in duplex mode)		Antenna		Check	Power Output: 4.5±0.5W

Duplex sensitivity	Turn to CH1, and operate in duplex mode	BPF:0. 3~3KHz AF OUT: 1KHz/150mV	Antenna		Check	Sensitivity squelch on transceiver: -119±3dBm  Sensitivity squelch off: -120±3dBm
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## TR-50 Part List 1

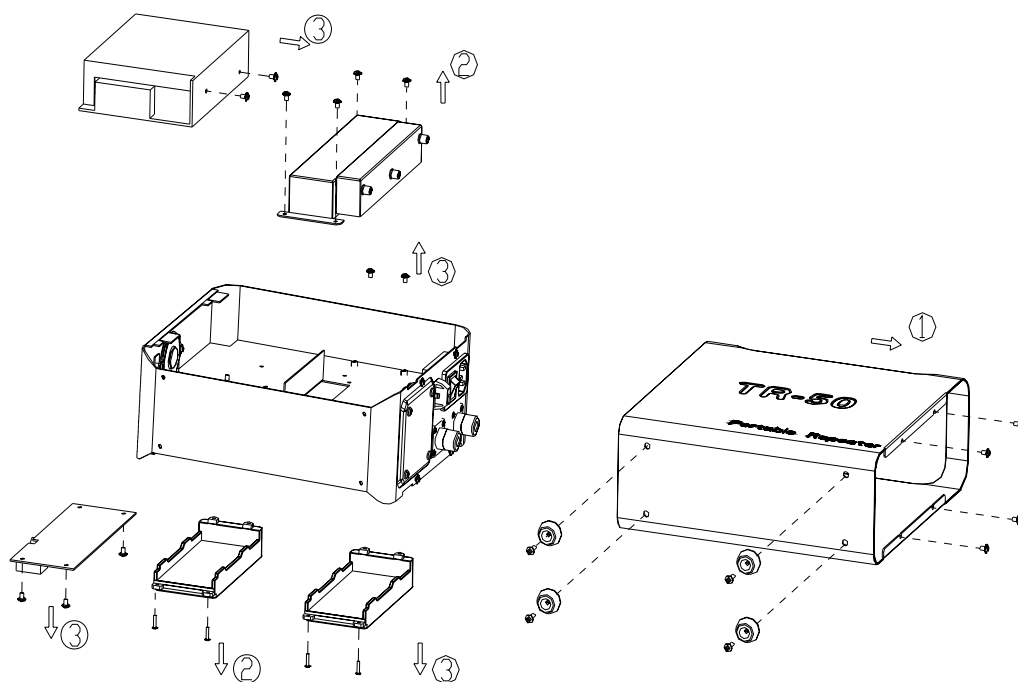
No.	Part No.	Description	Ref. Symbol.	Location	Sum.
1	01031002	Resistor 0603 10Ω J	R20	T1B	1
2	01033932	Resistor 0603 39KΩ J	R17	T1B	1
3	01051022	Resistor 0805 1KΩ J	R3	T3B	1
4	01051032	Resistor 0805 10KΩ J	R11	T1A	
5	01051032	Resistor 0805 10KΩ J	R6	T4A	
6	01051032	Resistor 0805 10KΩ J	R16	T1B	3
7	01051202	Resistor 0805 12Ω J	R21	T1B	
8	01051202	Resistor 0805 12Ω J	R18	T3C	
9	01051202	Resistor 0805 12Ω J	R19	T1B	3
10	01051222	Resistor 0805 1.2KΩ J	R14	T5C	1
11	01051532	Resistor 0805 15KΩ J	R7	T4A	1
12	01052022	Resistor 0805 2KΩ J	R9	T2A	1
13	01053022	Resistor 0805 3KΩ J	R22	T1A	
14	01053022	Resistor 0805 3KΩ J	R10	T2A	2
15	01054712	Resistor 0805 470Ω J	R4	T4B	1
16	01055122	Resistor 0805 5.1KΩ J	R5	T4B	1
17	01061022	Resistor 1206 1KΩ J	R8	T5A	1
18	0122473H	Trimmable resistor 47KΩ MVR22HXBRN473	VR1	T3B	1
19	02051043	Capacitor 0805 0.1uF K 25V	C10	T1B	
20	02051043	Capacitor 0805 0.1uF K 25V	C11	T1B	2
21	02054713	Capacitor 0805 470P K 50V	C1	T4B	
22	02054713	Capacitor 0805 470P K 50V	C2	T5A	
23	02054713	Capacitor 0805 470P K 50V	C5	T4A	
24	02054713	Capacitor 0805 470P K 50V	C6	T4A	4
25	02054733	Capacitor 0805 0.047uF K 25V	C9	T1B	1
26	02054743	Capacitor 0805 0.47uF K 16V	C7	T1B	1
27	0417AV70	Double diode BAV70	D4	T5A	
28	0417AV70	Double diode BAV70	D8	T1B	2
29	0417AW56	Double diode BAW56	D2	T2A	1
30	0501798D	PNP 2SB798-T1(DK)	Q3	T5A	1
31	0506114E	Bias Resistor, NPN DTC114EE(TL)	Q5	T1A	1
32	05173906	PNP MMBT3906	Q2	T5A	
33	05173906	PNP MMBT3906	Q4	T5A	
34	05173906	PNP MMBT3906	Q6	T1A	3
35	07LM3860	OP Amp NJM386M	IC2	T1B	1
36	18002802	TR-50 CNPCB FR4 1.2T/2L/1			1

37	T0610155	1206 TMCSA1A155MTR.1.5UF/10V.M	C3	T3C	1
38	T0616106	Ta-capacitor1206 TMCMA1C106MTR 10uF 16V	C8	T1B	
39	T0616106	Ta-capacitor1206 TMCMA1C106MTR 10uF 16V	C13	T1B	2
40	T0635104	Ta-capacitor1206 TMCSA1V104MTR.0.1uF 35V.M	C4	T3C	

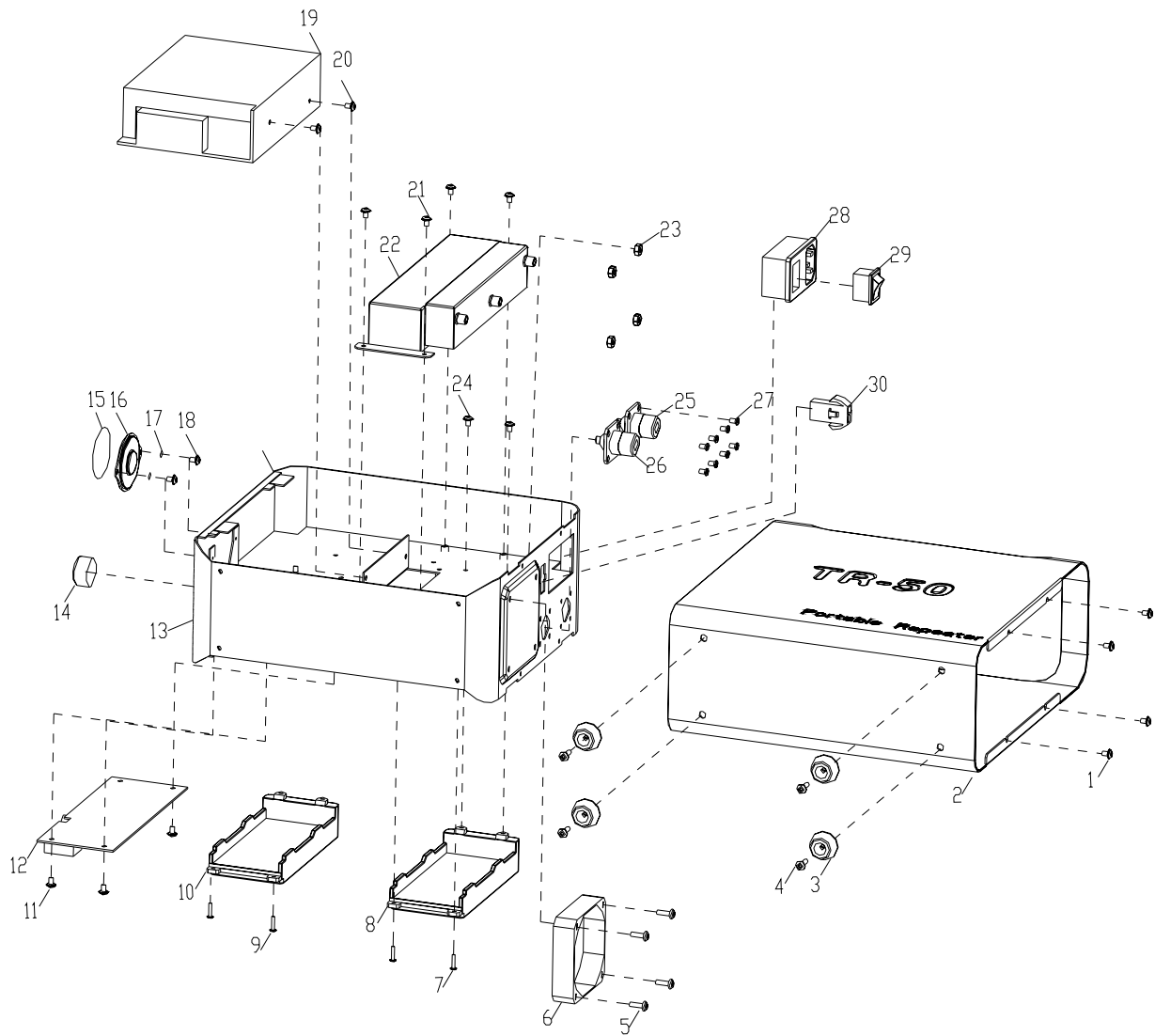
## Assembly and Disassembly for Repair

### Disassemble the main unit

1. Remove with tool the four screws on the rear side of main unit, and the four on the bottom of the main unit together with the rubber gasket. Pull out the outer cover.
2. Remove the four screws fixing the duplexer and then remove those fixing the transceiver.
3. Remove the screws fixing transmitter, power supply, and control board.
4. Remove the accessories such as fan and Jack.



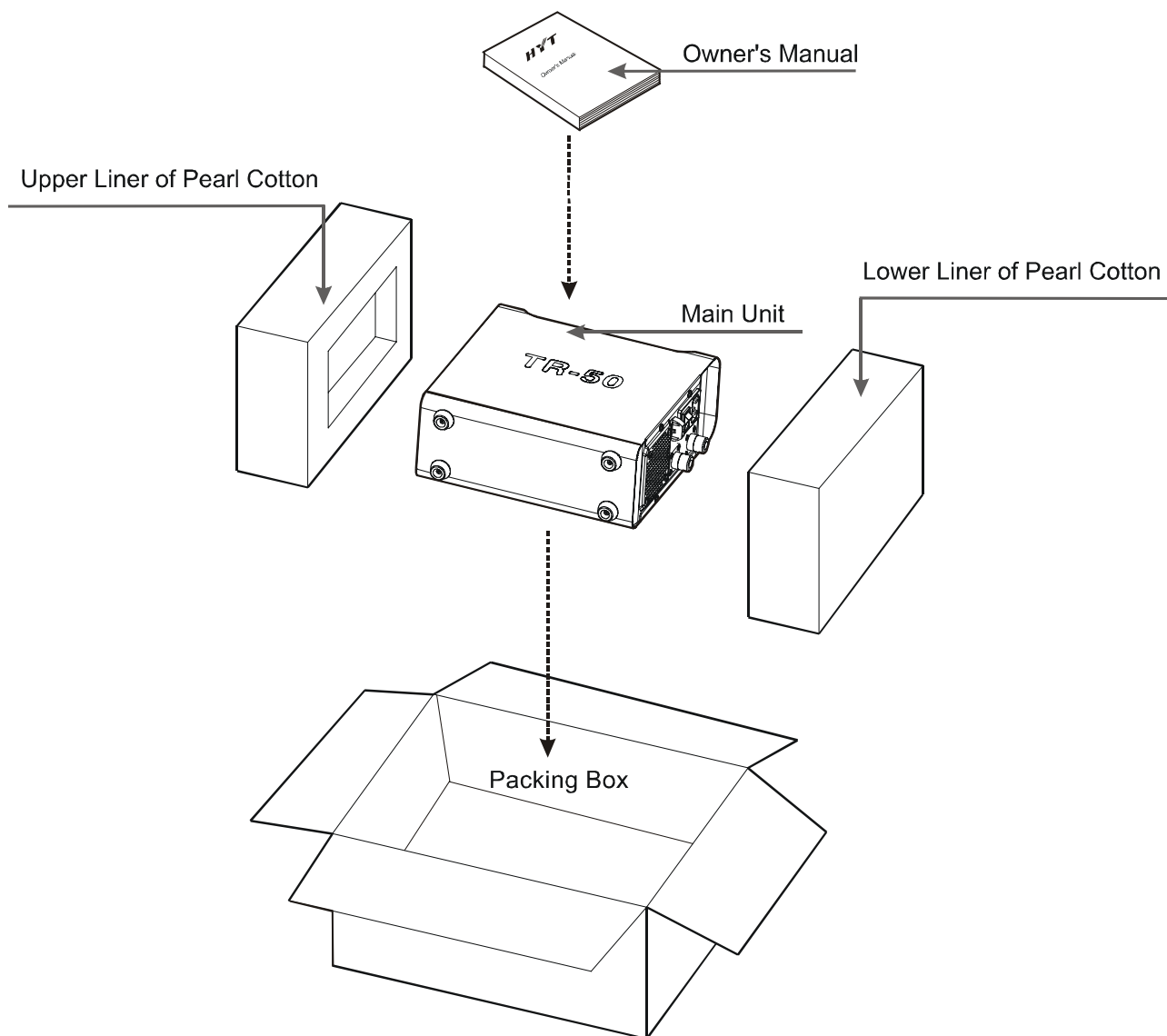
# Exploded View



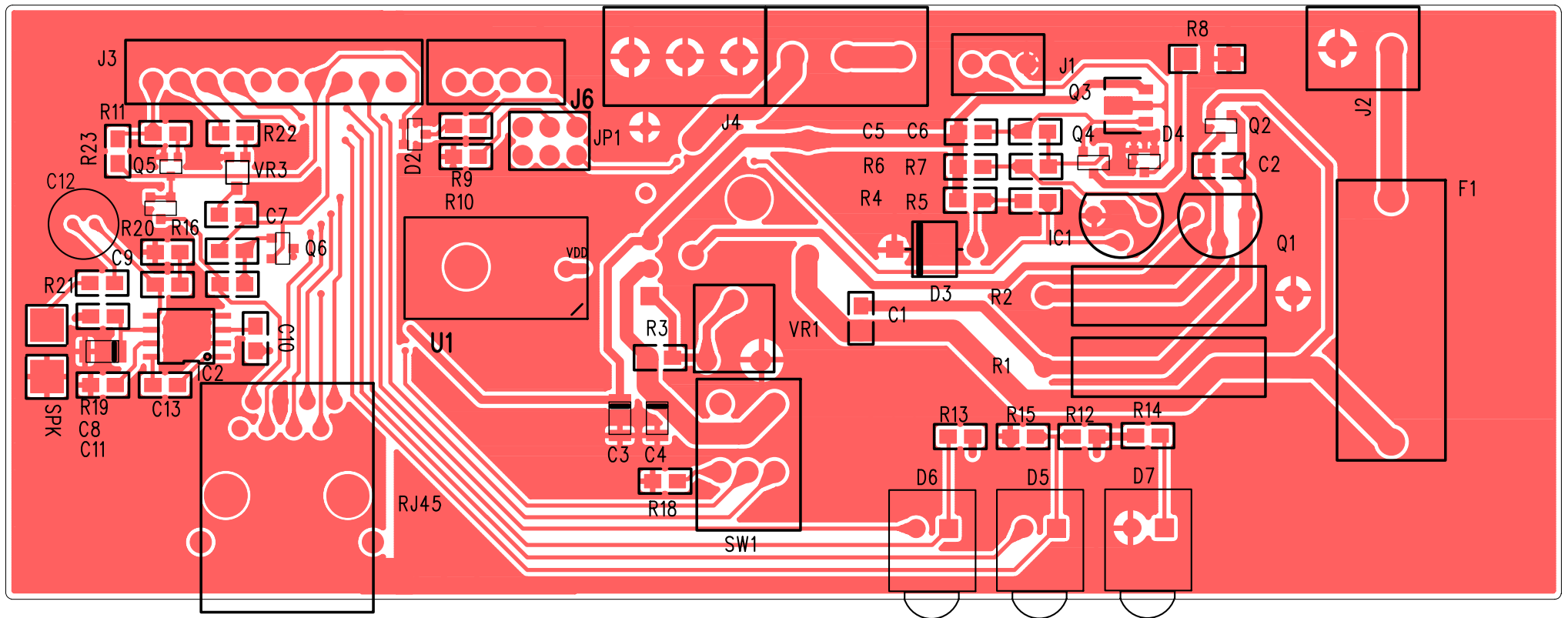
## Part List 2

No.	Material No.	Material Name
1	14090360	M3×6 Screw (zinc-plated, black)
2	1413200A	TR50 Cover
3	1613000A	TR50 Rubber foot mat
4	14090360	M3×6 Screw ( zinc-plated, black)
5	14090420	Screw M4×20
6	19130030	Fan 12V 0.17A
7	14052010	Machine Screw M2×10 (zinc-plated, color)
8	0050107100	Transmitter
9	14052010	Machine Screw M2×10 (zinc-plated, color)
10	0050107100	Receiver
11	14090360	M3×6 Screw (zinc-plated, black)
12	0950100710	TR50 Control Board
13	1413201A	TR50 Machine case
14	1513000A	TR50 Knob (vol)
15	1713008A	Sponge gasket (SP)
16	13130805	Speaker
17	1713009A	Fast bar washer
18	14026010	Screw M3×6
19	1904020A	MC-500N Switching power supply
20	14090360	M3×6 Screw ( zinc-plated, black)
21	14090360	M3×6 Screw ( zinc-plated, black)
22	08MODUP10000	TR-50 duplexer
23	14090430	M4 Hex nut
24	14090360	M3×6 Screw (zinc-plated, black)
25	08130002	Antenna receptacle (Tx)
26	08130002	Antenna receptacle (Rx)
27	14040360	M3×6 Screw (flat head)
28	08130006	AC receptacle
29	1904019A	AC Switch
30	08131102	DC Jack

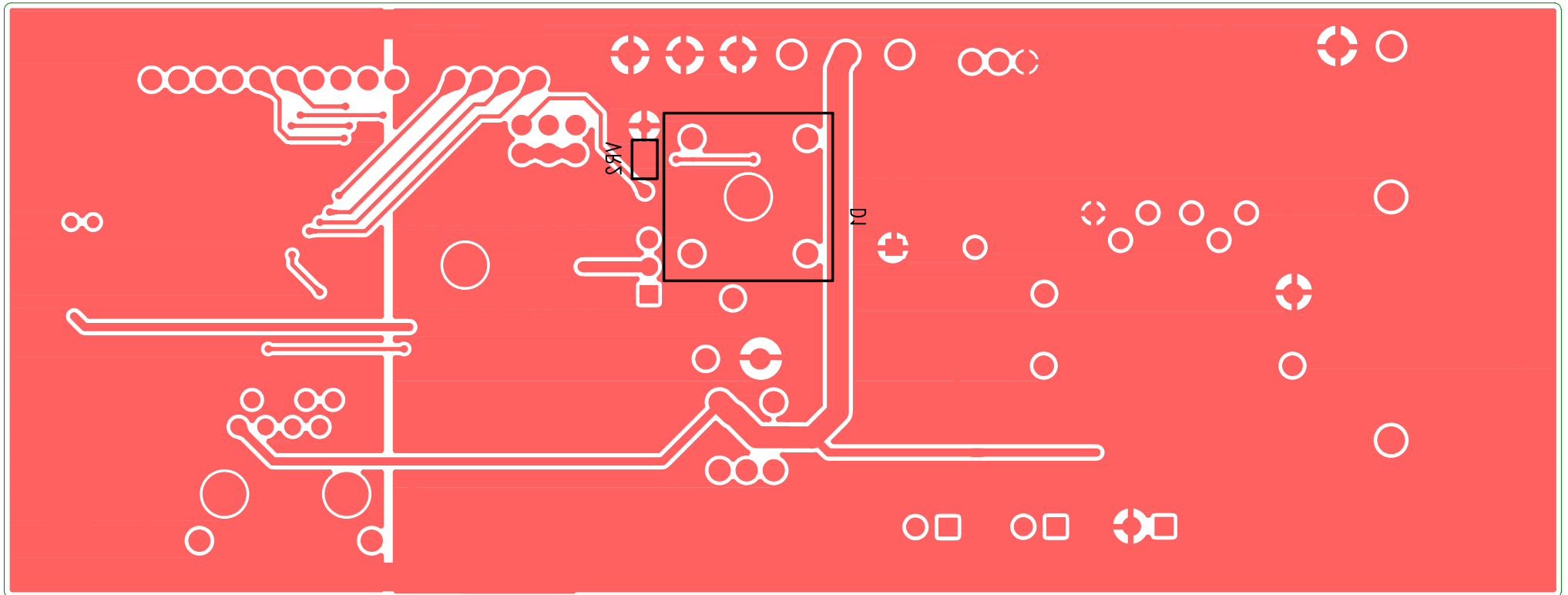
# Packing



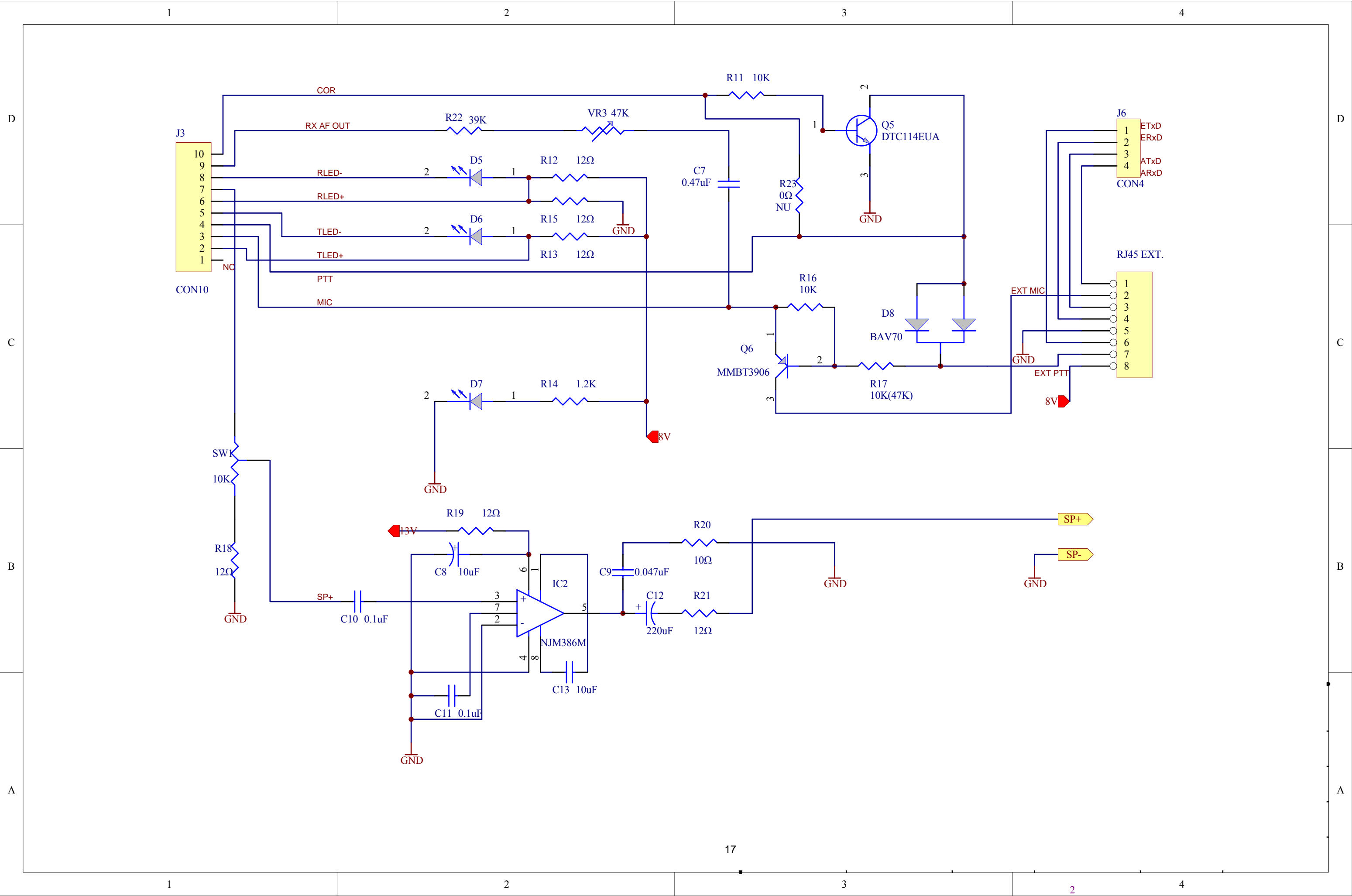
## TR-50 PC Board View (Top Layer)



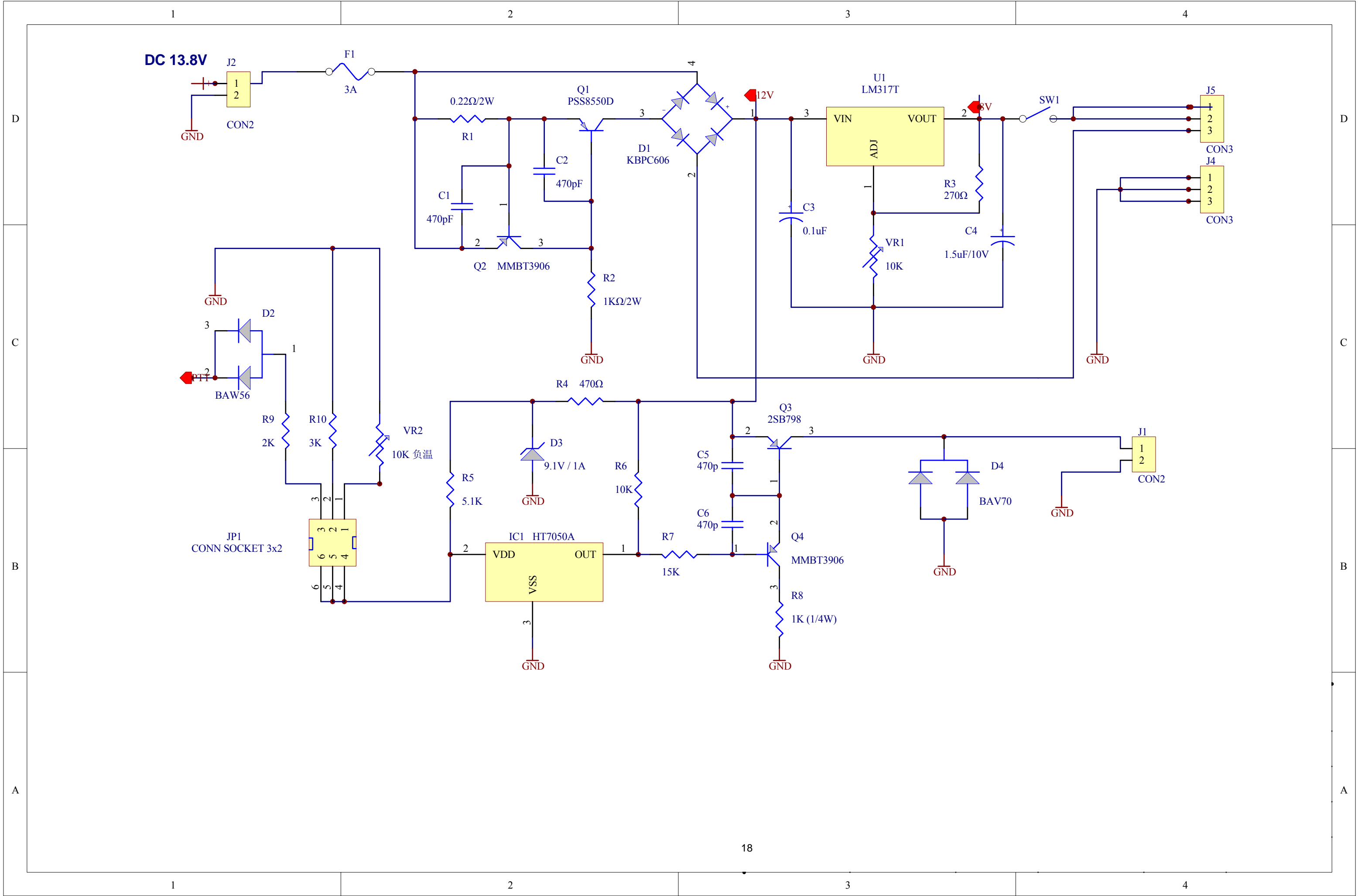
## TR-50 PC Board View (Bottom Layer)



TR-50 Schematic Diagram (RIC)



TR-50 Schematic Diagram (Power Management Board)



## Specifications

Frequency Range	146.0000MHz-174.0000MHz 440.0000MHz-470.0000MHz
Channel	1
Frequency Capacity	$\leq \pm 5\text{PPM}$
Valid Transmit Power	$\leq 5\text{W}$
Transmitter Spurious Radiation	$\leq 50\mu\text{W}$
Modulation Limit	$\pm 5.0\text{KHz}$
Occupied Bandwidth	$\leq 8.5\text{KHz}$
Adjacent Channel Power Rejection	$\geq 55\text{dB}$
Modulation AF Distortion	$\leq 5\%$
Receive Sensitivity	$\leq 0.3\mu\text{V}$ (12dB SINAD)
Co-channel Rejection	$\geq -8\text{dB}$
Blocking	$\geq 85\text{dB}$
Inter-modulation Rejection	$\geq 50\text{dB}$
Adjacent Channel Selectivity	$\geq 50\text{dB}$
Receiver Spurious Radiation	$\leq 20\text{nW}$
Receive AF Distortion	$\leq 5\%$